Check List the journal of biodiversity data

NOTES ON GEOGRAPHIC DISTRIBUTION

Check List 12(3): 1912, 23 June 2016 doi: http://dx.doi.org/10.15560/12.3.1912
ISSN 1809-127X © 2016 Check List and Authors

Distribution extension of *Syphacia* (*Seuratoxyuris*) *peromysci* Harkema, 1936 (Nematoda, Syphaciinae) parasitizing the Rock Mouse, *Peromyscus difficilis* (J. A. Allen, 1891) (Rodentia, Neotominae) in central Mexico

Jorge Falcón-Ordaz[1*], **Jesús A. Fernández**[2] and **Belén Aline Ruíz-Vázquez**[1]

1 Universidad Autónoma del Estado de Hidalgo, Laboratorio de Morfología Animal, Ciudad Universitaria, Carretera Pachuca-Tulancingo s/n Km 4.5, 42184, Mineral de la Reforma, Hidalgo, México

2 Universidad Autónoma de Chihuahua, Departamento de Recursos Naturales, Facultad de Zootécnia y Ecología, Periférico Francisco R. Almada Km 1, 31453, Chihuahua, México

* Corresponding author. E-mail: jfalcon.ordaz@gmail.com

Abstract: As a part of an ongoing project in order to inventory the helminth parasites of rodents in Mexico, 49 individuals of *Syphacia* (*Seuratoxyuris*) *peromysci* were collected from five specimens of the Rock Mouse *Peromyscus difficilis* caught in Veracruz state, Mexico. This is the first report of *S. peromysci* in a Mexican endemic rodent, widening the known distribution of the species to the southern portion of the country.

Key words: rodent; taxonomy; helminth fauna; geographic distribution

The Rock Mouse, *Peromyscus difficilis* (J. A. Allen, 1891) is a Mexican endemic cricetid rodent, distributed from southwestern Chihuahua and southeastern Coahuila to north-central Oaxaca, including the states of Durango, Zacatecas, San Luis Potosi, Guanajuato, Mexico, Puebla, Hidalgo, Tlaxcala, Veracruz, and Oaxaca (Fernandez et al. 2010). This rodent species has been studied for helminths in Mexico since 1990; its helminthological record comprises two trematodes (Brachylaimidae gen. sp. and *Caballerolecythus ibunami*), five Cestodes (*Catenotaenia peromysci*, Dilepididae gen. sp., *Hymenolepis diminuta*, *Rodentolepis* sp., and *Taenia pisiformis*) and seven Nematodes (*Carolinensis huehuetlana*, *Syphacia* sp., *Stilestrongylus peromysci*, *Vexillata vexillata*, *Protospirura mexicana*, *Calodium hepaticum* and *Trichuris fossor*), distributed in Hidalgo, Mexico, Tlaxcala, and Veracruz states (see García-Prieto et al. 2012). The main goal of this report is to add one nematode species to the helminth fauna of this host species: *Syphacia* (*Seuratoxyuris*) *peromysci* Harkema, 1936 infecting an endemic rodent in the Oriental Basin of central Mexico.

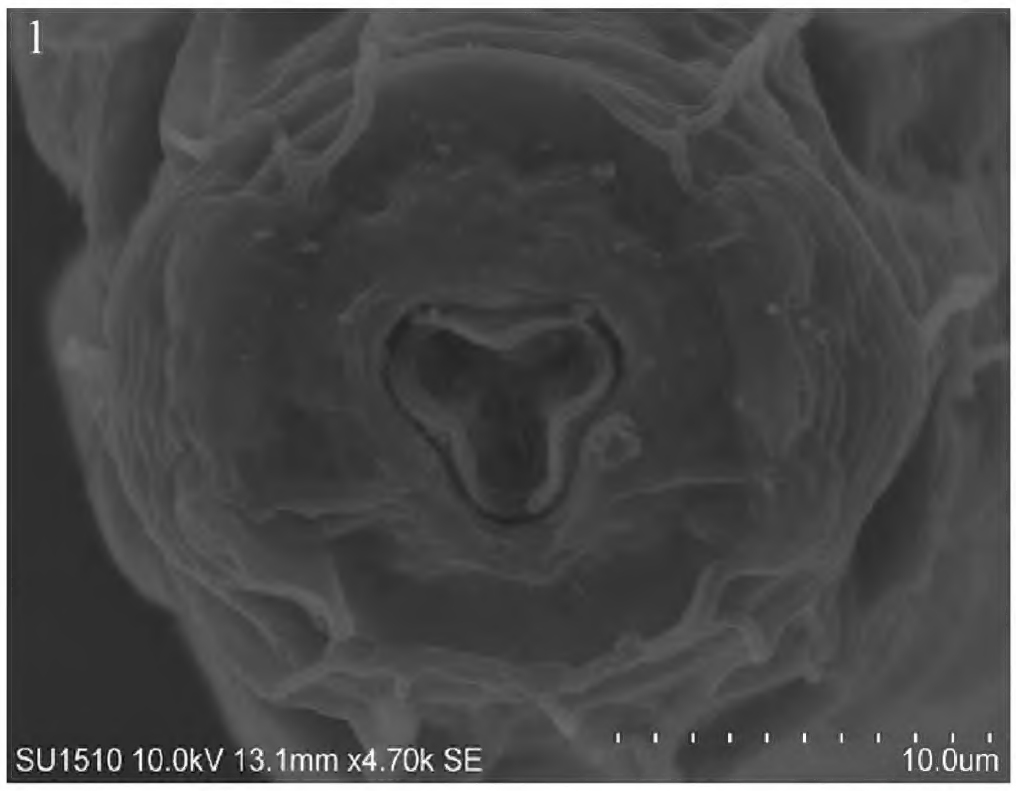
Between June, 2007 and July, 2008, five specimens of *P. difficilis* were caught under permit FAUT-0002 (issued to F. A. Cervantes) 3 km south of El Frijol Colorado (19°34′20″ N, 097°23′00″ W), Municipality of Perote, Veracruz, México, 2,437 m above sea level. The collecting and processing of rodents followed the guidelines of the American Society of Mammologists for use of wild animals in research (Kelt et al. 2010; Sikes et al. 2011). The intestine of hosts was examined for helminths under microscope; nematodes recovered were washed in 0.85% saline solution, and fixed in 4% hot formalin. For morphologic study, nematodes were cleared with Amman's lactophenol. All measurements are given in micrometers (μm) unless otherwise indicated. Measurements are recorded as the range followed by the mean and standard deviation in parentheses. For scanning electron microscopy (SEM) study, nematodes were dehydrated in series of gradual ethyl alcohol and critical point dried with carbon dioxide. Specimens were coated with a gold-palladium mix- ture and examined in a Hitachi Stereoscan Model SU 1510 at 10kV. Parasite voucher specimens were deposited at Colección Nacional de Helmintos (CNHE), Instituto de Biología, Universidad Nacional Autónoma de México (IBUNAM), Mexico City.

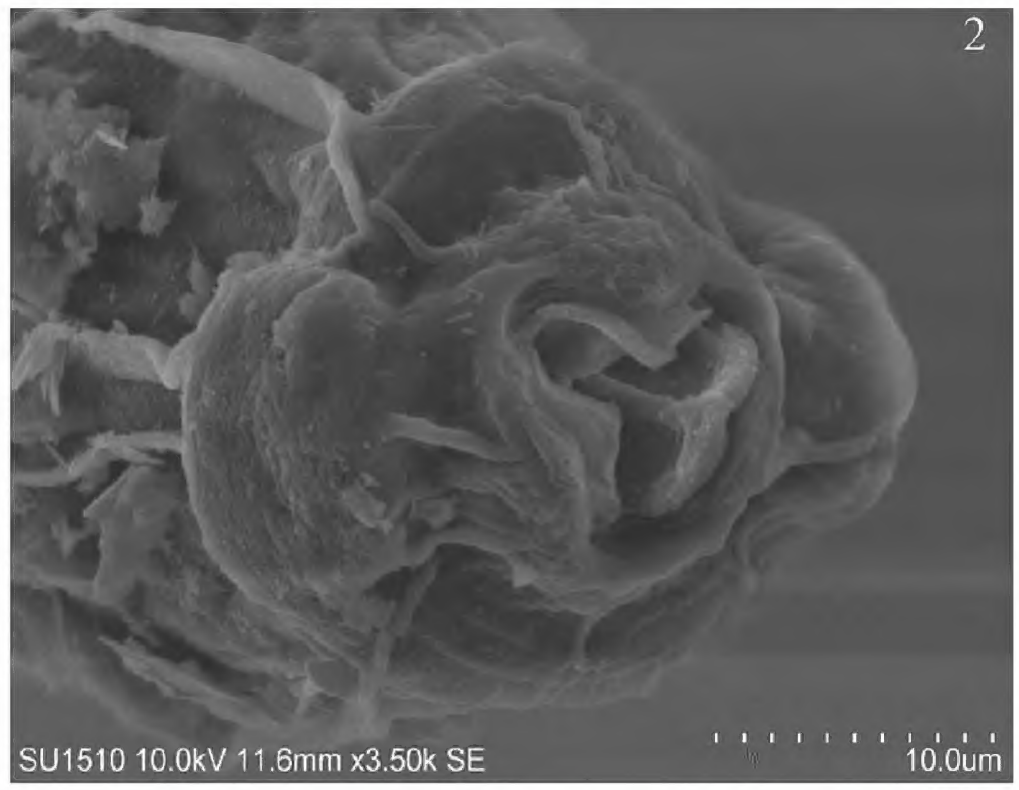
Syphacia* (*Seuratoxyuris*) *peromysci Harkema, 1936

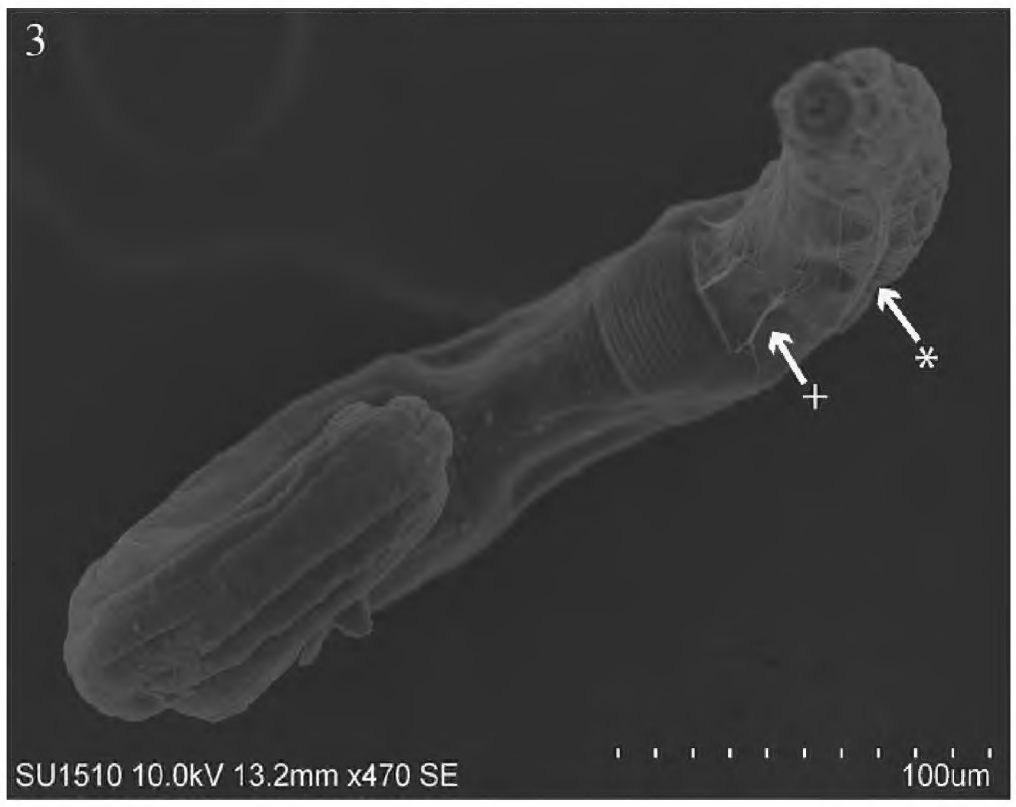
Description based on 49 specimens (25 males and 24 females) identified as *S. peromysci* (CNHE 5671) recovered from the caecum of one specimen of *P. difficilis*.

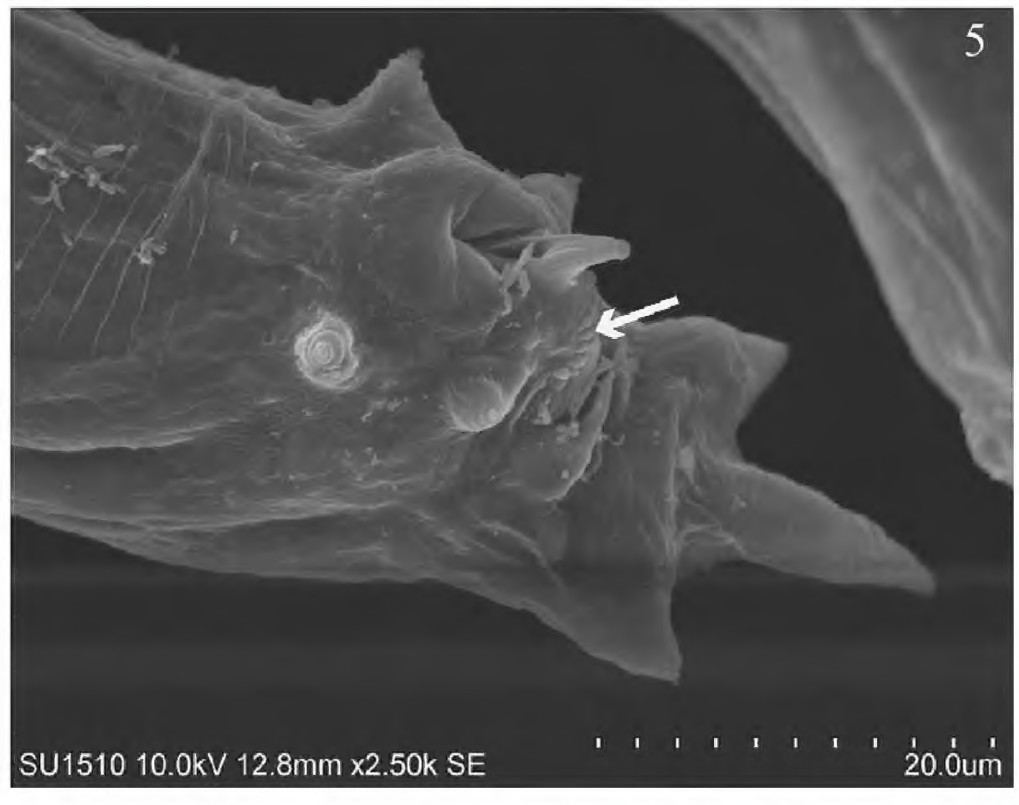
Taxonomic identification of *S. peromysci* follows Hugot (1988), Kruidenier et al. (1961) and Quentin

and Kinsella (1972). This species is characterized by the following traits: 1) cephalic plate quadrangular (males) or elongated (females) (Figure 1 and 2); 2) dorsal and ventral papillae in the cephalic plate close to amphids; 3) cervical alae well developed in both sexes (Figures 3 and 4); 4) deirids developed in females; 5) cloacal papillae arranged in a square; 6) accesory hook in lateral view with five small chitinous ornamentations in lateral view (Figure 5) (Hugot, 1988). In addition, males have three cuticular folds between the excretory pore and the first









Figures 1–5. *Syphacia* (*Seuratoxyuris*) *peromysci* Harkema, 1936. **1.** Male, mouth apical view. **2.** Female apical view. **3.** Male, total view; showing the cervical alae (white asterisk *) and ventral cuticular swelling (white cross +). **4.** Female showing the cervical alae (white arrow). **5.** Detail of posterior end of male, showing five small chitinous ornamentations (white arrow).

ventral cuticular mamelons (Figure 3) as well as between the third ventral cuticular swelling and the cloacal papillae (Figure 5).

Male measurements: Body length 0.37–0.957 mm (0.68 ± 0.113 mm), width at midbody 60–102 (82 ± 11). Esophagus 108–178 (134 ± 16) in total length, esophageal bulb 43–75 (51 ± 6) long. Nerve ring 65–95 (78 ± 7), and excretory pore 113–203 (64 ± 39) from anterior end. Three ventral *Syphacia*-type mamelons present. Anterior mamelon protuding, 23–84 (76 ± 163) long; middle mamelon 23–50 (43 ±6) long and posterior mamelon 23–63 (46 ± 9) long. Distance between posterior edge of anterior mamelon and anterior edge of middle mamelon 8–70 (43 ± 14); distance between posterior edge of middle mamelon and anterior edge of posterior mamelon 38–113 (64 ±17). Spicule 25–60 (25 ± 12) long, gubernaculum 13–28 (13 ± 5) long. Anus 23–58 (28 ± 9) from posterior end. Tail short 5–43 (28 ± 47) long.

Females measurements: Body length 0.895–2.3475 mm (1.516 ± 0.449 mm), width at midbody 62.5–125 (98 ± 17). Esophagus 112–255 (176 ± 37) in total length, esophageal bulb 42–80 (65 ± 9) long. Nerve ring 62.5–132 (99 ± 19) and excretory pore 282.5–562.5 (20, 349 ± 86) from anterior end. Vulva slightly prominent, situated at 187–412 (*n*=15, 293 ± 75) from anterior end. Anus 25–125 (67 ± 25) from posterior end. Eggs not observed.

The nematode genus *Syphacia* Seurat, 1916 includes more than 67 parasite species of rodents (Dewi and Hasegawa 2014; Dewi et al. 2014a, 2014b, 2015; Robles et al. 2014); this genus was divided into three subgenera by Hugot (1988), two distributed in North and South America, Asia, Australia and Europe (*Seuratoxyuris* Hugot, 1988 and *Syphacia* Seurat, 1916) and one (*Cricetoxyuris* Hugot, 1988) in Africa.

Our specimens were included in the subgenus *Seuratoxyuris* by having cephalic plate round, oval and laterally elongated in females, and a submedian papillae located in the first or second third to half of cephalic plate (measuring from position of amphids); in addition, the cuticle have characteristic superficial pattern (alternating parallel rings and perpendicular ridges); the accessory hook of gubernaculum presents ornamentations covering its entire surface, and the tail is short and conical in males. *Seuratoxyuris* differs of *Syphacia* and *Cricetoxyuris* by the morphology of cephalic plate (circular and quadrangular, respectively). Other traits that allow differentiating *Seuratoxyuris* is the presence of a lateral alae vestigial or absent in females, while in *Syphacia* and *Cricetoxyuris* the lateral alae is well developed. (Hugot 1988; Hugot et al. 2013; Robles et al. 2014).

Syphacia peromysci was described by Harkema (1936) as parasite of *Peromyscus leucopus* in North Carolina, USA. Since then, this taxon has been recorded in several species of *Peromyscus* (*P. gossypinus*, *P. leucopus*, *P. maniculatus*, and *P. polionotus*; Dyer 1969; Grundman et al. 1976; Kinsella 1991; Luong et al. 2013; Quentin and Kinsella 1972) also in USA. In Mexico this species has been recorded in *P. maniculatus* in Hidalgo (Pulido-Flores et al. 2005).

On the other hand, some rodent species kept in pet shops, have been reported as host of *S. peromysci*: *Acomys cahirinus*, *Mesocricetus auratus*, and *Pachyuromys duprasi* (Hasegawa et al. 2008). The presence of this nematode species in such rodents is of special interest, because apparently, pet breeders' facilities provide suitable conditions for host capture by pinworms, which may seldom occur under natural conditions. The presence of *S. peromysci* in *Reithrodontomys megalotis* and *Xerospermophilus spilosoma*, reported by Frandsen and Grundmann (1947) and Ubelaker et al. (2010), respectively, can be attributed to behavioral habits of rodents who build their nests in abandoned burrows (Villa and Cervantes 2003).

We report some variations in selected traits of females analyzed in this study regarding previous reports; for example, distance from vulva to anterior region in our specimens is shorter (187–412), than those recorded by Harkema (1936) and Kruidenier et al. (1961) (507–700). Similarly, females examined by Quentin and Kinsella (1972) have a total length of 4.0 mm opposite to 0.895–2.3475 mm recorded in the Mexican material; females recorded by Harkema (1936) and Kruidenier et al. (1961) measure 2.0–3.2 mm. However, we consider these traits just as intrinsic variability of the species because the diagnostic characteristics of this species are: the cephalic plate morphology in male and female as well as the number of ornamentations on accessory hook of gubernaculum.

The present study provides the first report of *S. peromysci* in an endemic rodent from Mexico, expanding the known distribution range of the species south of the country.

ACKNOWLEDGEMENTS

The authors thank Berenit Mendoza-Garfias for her technical assistance with scanning electron microscopy. This study was partially funded by a research grant "Apoyo a la Incorporación de Nuevos PTC", PROMEP-SEP to JFO.

LITERATURE CITED

Dewi, K., M. Asakawa and Y. S. Fitriana. 2014a. *Syphacia* (*Syphacia*) *semiadii* n. sp. (Nemata:Oxyuridae) from *Halmaheramys bokimekot* Fabre et al., 2013 (Rodentia: Muridae) on Halmahera Island, Indonesia and a key to the species present in Sulawesi and the Australian Bioregion. Transactions of the Royal Society of South Australia 138 (1): 98–104. doi:10.1080/03721426.2014.10887193

Dewi, K and H. Hasegawa. 2014. Two new species of *Syphacia* (Nematoda: Oxyuridae) in endemic murid rodents from Sulawesi, Indonesia. Journal of Helminthology 88 (1):41–49. doi: 10.1017/S0022149X12000703

Dewi, K., H. Hasegawa and M. Asakawa. 2014b. Description of two new species of *Syphacia* (Nematoda: Oxyuridae) collected

from *Europeplus canus* (Rodentia: Muridae), an endemic rat of Sulawesi, Indonesia, with proposal of new subgenera. Raffles Bulletin of Zoology 62: 647–654.

Dewi, K., H. Hasegawa Y.S. Fitriana and M. Asakawa. 2015. *Syphacia* (*Syphacia*) *maxomyos* sp. n. (Nematoda: Oxyuridae) from *Maxomys* spp. (Rodentia: Muridae) from Sulawesi and Sumatra, Indonesia. The Journal of Veterinary Medical Science 77(10): 1217–1222. doi: 10.1292/jvms.14-0659

Dyer, G.W. 1969. A checklist of the protozoa and helminths of the Deer Mouse, *Peromyscus maniculats* in North America. The American Midland Naturalist 81(1): 258–262.

Fernández, J.A., F. García-Campusano and M.S. Hafner. 2010. *Peromyscus difficilis* (Rodentia, Cricetidae). Mammalian Species 42(867): 220–229. doi: 10.1644/867.1

Frandsen, J.C. and A.W. Grundmann. 1947. Endoparasitism in isolated populations of rodents of the Lake Bonneville Basin, Utah. Journal of Parasitology 47(3): 391–396.

García-Prieto, L., J. Falcón-Ordaz and C. Guzmán-Cornejo. 2012. Helminth parasites of Mexican mammals: list of species, hosts and geographical distribution. Zootaxa 3290: 1– 92.

Grundman, A.W., R.G. Warnock and D.L. Wasson. 1976. Some mechanisms of natural regulation of parasitic helminth populations. American Midland Naturalist 95(2): 347–360.

Hasegawa, H., H. Sato, E. Iwakiri, Y. Ikeda and Y. Une. 2008. Helminths collected from imported pet murids, with special reference to concomitant infection of Golden Hamsters with three pinworm species of the genus *Syphacia* (Nematoda: Oxyuridae). Journal of Parasitology 94 (3): 752–754. doi: 10.1645/GE-13471.1

Harkema, R. 1936. The parasites of some North Carolina rodents. Ecological Monographs 6(2): 151–232.

Hugot, J.P. 1988. Les nématodes Syphaciinae parasites de rongeurs et de lagomorphes. Taxonomie, zoogeographie, evolution. Mémoires du Muséum National d'Histoire Naturelle (A) 141: 1–153.

Hugot, J. P., C. Feliu, B. Douangbopha and A. Ribas. 2013. *Laoxyuris laonasti* n. gen., n. sp. (Nematoda, Syphaciinae) parasite of *Laonastes aenigmamus* (Rodentia, Diatomyidae): Morphology, biology, taxonomy, phylogeny. Infection, Genetics and Evolution 16: 113–121. doi: 10.1016/j.meegid.2013.01.003

Kelt, D.A., M.S. Hafner and the American Society of Mammalogists' ad hoc Committee for Guidelines on Handling Rodents in the Field. 2010. Updated guidelines for protection of mammalogists and wildlife researchers from hantavirus pulmonary syndrome (hps). Journal of Mammalogy 91(6):1524–1527. doi. 10.1644/10-MAMM-A-306.1

Kinsella, J.M. 1991. Comparison of helminths of three species of mice, *Podomys floridanus*, *Peromyscus gossypinus*, and *Peromyscus polionotus*, from southern Florida. Canadian Journal of Zoology 69(2): 3078–3083. doi: 10.1139/z91-432

Kruidenier, F.J., K.N. Mehra and R. Harkema. 1961. Comparative studies of *Syphacia peromysco* and *S. samorodini* (Nematoda: Oxyuridae). Journal of Parasitology 47(1): 47–52.

Luong, L.T., E.G. Chapman, J.D. Harwood and P.J. Hudson. 2013. Linking predator-prey interactions with exposure to a trophically transmitted parasite using PCR-based analyses. Molecular Ecology 22(1): 239–248. doi: 10.1111/mec.12095

Pulido-Flores, G., S. Moreno-Flores and S. Monks. 2005. Helminths of rodents (Rodentia: Muridae) from Metztitlán, San Cristóbal, and Rancho Santa Elena, Hidalgo, Mexico. Comparative Parasitology 72(2):186–192. doi: 10.1654/4146

Quentin, J.C. and J.M. Kinsella. 1972. Étude de trois espèces d'Oxyures Syphacia parasites de Rongeurs Cricétidés nord-américains. Annales de Parasitologie 46(5): 717–733.

Robles, M.R. 2010. La importancia de los nematodes Syphaciini (Syphaciinae, Oxyuridae) como marcadores especifícos de sus hospederos. Mastozoologia Neotropical 17(2): 305–315. http://www.sarem.org.ar/wp-content/uploads/2012/11/SAREM_MastNeotrop_17-2_06_Robles.pdf

Robles, M.R., G. Panisse and G.T. Navone. 2014. A new species of *Syphacia* (*Seuratoxyuris*) (Nematoda, Oxyuridae) from *Sooretamys angouya* Fischer, 1814 (Rodentia, Cricetidae) in Argentina. Acta Tropica 139: 23–31. doi: 10.1016/j.actatropica.2014.06.011

Sikes, R.S., E.L. Gannon and the Animal Care and Use Committee of the American Society of Mammalogists. 2011. Guidelines of the American Society of Mammalogists for the use of wild mammals in research. Journal of Mammalogy 92(1): 235–253. doi: 10.1644/10-MAMM-F-355.1

Ubelaker, J.E., S.I. Chudhri, P.P. Clifford and D.W. Duszynski. 2010. Helminth parasites of the spotted ground squirrel, *Xerospermophilus* (syn. *Spermophilus*) *spilosoma* (Bennett, 1833) Helgen, Cole, Helgen, and Wilson, 2009, from Central New Mexico, U. S. A. Comparative Parasitology 77(2): 178–182. doi: 10.1654/4398.1

Villa, R.B. and Cervantes, F.A. 2003. Los Mamíferos de México. México D.F.: Grupo Editorial Iberoamericana, S. A. de C. V. 140 pp.

Author contributions: JFO collected and necropsied the hosts, identified the nematodes and wrote the text; JAF collected the hosts and wrote the text; BARV processed and identified the nematodes.

Received: 6 October 2015
Accepted: 7 June 2016
Academic editor: Simone Chinicz Cohen